Headcase promotes cell survival and niche maintenance in the Drosophila testis.

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Public Summary:
This work uses the fruit fly male germline as a model system to examine the manner in which a stem cell environment (niche) responds to damage, in order to maintain it's role in regulating stem cell behavior and tissue homeostasis. We find that pathways that prevent cell death are very important in preserving niche function. In addition, we developed a system by which we can conditionally ablate (kill) niche support cells. This strategy allowed us to examine how reduction in the size of the niche leads to a concomitant loss of stem cells, providing information as to how niche size and stem cell number scales before and after damage. Therefore, our data provide important insight into the design and composition of niches built in vitro to support the maintenance and expansion of stem cells in culture.

Scientific Abstract:
At the apical tip of the Drosophila testis, germline and somatic stem cells surround a cluster of somatic cells called the hub. Hub cells produce a self-renewal factor, Unpaired (Upd), that activates the JAK-STAT pathway in adjacent stem cells to regulate stem cell behavior. Therefore, apical hub cells are a critical component of the stem cell niche in the testis. In the course of a screen to identify factors involved in regulating hub maintenance, we identified headcase (hdc). Hub cells depleted for hdc undergo programmed cell death, suggesting that anti-apoptotic pathways play an important role in maintenance of the niche. Using hdc as paradigm, we describe here the first comprehensive analysis on the effects of a progressive niche reduction on the testis stem cell pool. Surprisingly, single hub cells remain capable of supporting numerous stem cells, indicating that although the size and number of niche support cells influence stem cell maintenance, the testis stem cell niche appears to be remarkably robust in the its ability to support stem cells after severe damage.